SELECTION OF THE WARSHIP AS AN AUXILIARY SHIP FOR THE DISTRIBUTION OF AMMUNITION TO SUPPORT THE NAVY TASK

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ABSTRACT

Arsenal is a work unit that has the responsibility of storing, maintaining, and distributing weapons and ammunition supplies has not been able to support optimally because there is only one Arsenal, and must serve user units like the Indonesian Naval Base. spread throughout Indonesia and there is no special transportation of ammunition to distribute so the process of distributing ammunition depends on the element of the title. Distribution constraints faced with existing conditions will be planned for the selection of KRI in the assignment as an auxiliary ammunition ship. This study aims to determine the selection of the best ship for the assignment as an ammunition auxiliary ship using the Analytic Network Process (ANP) method. The use of the ANP method is based on the existence of data that has a relationship between criteria and a relationship between subcriteria. There are two main criteria used in conducting alternative selection, namely operational requirements criteria with five sub-criteria: Security, Geographical conditions, mobility, ship worthiness, sailing resistance, and technical requirements criteria with five sub-criteria: machining, navigation, platform safety equipment as well as sensors. The results of this study are an alternative priority for the selection of ships in the assignment as ammunition auxiliary ships to carry out the distribution of ammunition throughout the Indonesian Naval Base. The best alternative based on the main criteria and sub-criteria is the type of personnel transport auxiliary ship (BAP) with a score of 0.341260.

Keywords: Assignment, Analytic Network Process (ANP), and Auxiliary Ship for Ammunition.

1. INTRODUCTION

The Navy as an integral part of the Indonesian armed force must be able to support the main duties of the Indonesian armed force mandated in law no.34 of 2004. Based on Chief of Naval Staff Regulation number Perkasal/ 69/XI/ 2010 Navy logistics are all activities that aim to prepare and provide material and implementation of logistical support needed and used in the implementation of the entire Navy development system to realize a force capable of carrying out the duties of the Navy. One of the expected logistical support operation capabilities is to be able to provide sufficient provision support for the duration of the planned operation and can support basic provisions and re-provisions, one of the index norms is 5th class (ammunition) provisions.

The pattern of ammunition development that is oriented to facilitate the process of providing and supporting ammunition for TNI units, is essentially influenced by sources, facilities, and infrastructure as well as management procedures (Panglima TNI, 2011). The main ammunition distribution problem is that there is no special ship to transport ammunition so the distribution of ammunition is very dependent on the element of the title (KRI) that will operate.

Thus causing the problem of erratic distribution time. With the existing conditions and realities, the main problem that can be formulated in this study is how to determine the selection of the type of KRI that exists and is appropriate for assignment as an ammunition auxiliary ship and how to determine the criteria and critical subcriteria in the selection of ammunition auxiliary ships. The purpose of this study is to determine the priority of alternative types of existing ships and most appropriately for assignment as ammunition auxiliary vessels that meet operational requirements and technical requirements using the Analytic Network Process (ANP) method and

knowing the main subcriteria on the criteria for operational needs and technical requirements.

2. LITERATURE REVIEW

2.1 Distribution and Logistics Planning

a. Distribution

Distribution aimed at streamlining the supply of goods and services from producers to consumers and ensuring their use under what is needed (type, quantity, price, place, and needs) can be interpreted as marketing activities (Tjiptono, 2008). Distribution is the interdependent organizations that are covered in the process that makes a product or service available for use or consumption. They are the line devices that the product or service follows after production, which culminate in the buyer and use by the end user (Keller, 2007).

b. Logistics Planning

In the new concept, logistics problems are a very long process problem, starting from raw materials to finished products used by consumers. Logistics is the process of strategically procuring, moving, and storing materials, spare parts, and inventory of finished goods (and related information flows) through the organization and its marketing channels to generate current and future revenue through the fulfillment of coastal orders, so that efficiency is effectively maximized (Cristopher, 2005).

2.2 Decision Making

The essence of decision-making is that which lies in the formulation of various alternative actions according to what is being considered at the moment and in the selection of the right alternative after evaluating the effectiveness of the decision in achieving the goals that are intended. One of the most important elements of the decision-making process is to collect information to obtain an assessment of the decision-making situation. If enough information can be gathered to provide a complete specification of all alternatives and the degree of their effectiveness in a situation of concern the process of making or making relative decisions is absolutely easy. However, in practice, it is impossible to accumulate limited funds, time, and energy (Suprapto, 2006).

2.3 Analytic Network Process (ANP)

The Analytic Network Process (ANP) is a framework for addressing decision-making problems without considering assumptions about the independence between higher element levels and weaker elements, and the independence of elements within a level. This pairwise comparison process uses numbers/scales that reflect the decision's importance/priority towards other decisions at the same hierarchical level. It helps decision-makers compare all elements of the decision. as they only focus on two of them in pairwise comparison (Saaty, 1990). Table 1. the following shows the comparison scale in pairs.

Table 1. Pairwise Comparison

The scale of Importance Level	Definition
1	Both elements are equally important.
3	One element is slightly more important than the other.
5	One element is more important than another.
7	One element is more important than another.
9	One absolute element is more important than another.
2, 4, 6, 8	The middle grade is among the 2 side-by-side assessments.

(Source: The Analytic Hierarchy Process, Saaty,1990)

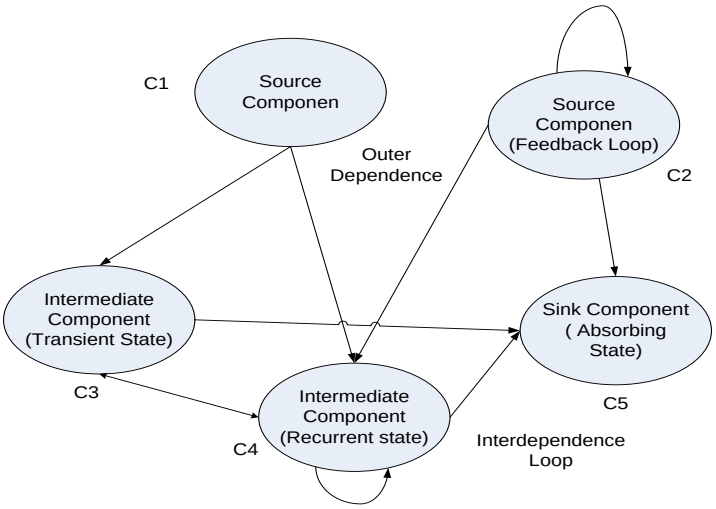

Figure 1. Structure feedback network

Some the decision problems cannot be arranged hierarchically because they involve the interaction and dependence of elements that are at a higher level with elements that are at a lower level. The level of alternative importance is not only determined based on the importance level of the criteria but also determined by the level of importance of the alternative itself. Feedback also makes it possible to factor the future into the present to determine what we should do to get the desired future.

This feedback structure does not have a straight shape from top to bottom as in the hierarchy but rather resembles a network with a cycle that connects the components in it to the components themselves. This structure also has sources and sinks. A source node is the origin of an influence path and is never the destination of that path. The sink node is the opposite of the source node i.e. the purpose of the influence path and will never be the source of the existing path. An example of a feedback network structure can be seen in Figure

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2.4 Criteria Determination.

The criteria used for the selection of ammunition auxiliary vessels are obtained from literature studies, interviews, and questionnaires with experts. From the results of literature studies, interviews, and questionnaires, criteria and subcriteria were obtained as in tables 3, 4, and 5. The table number is sub-criteria based on opsreq criteria, table number 4 is regarding the Techreq criteria and table 5 is the alternative ship.

Table 2. Criteria Used

No.	Criteria Raised	Definition / Assessment Parameters

1	Operational Requirements (Opsreq)	Operational requirements relating to the strategic value of Auxiliary Munitions Vessels
2	Technical Requirements (Techreq)	Technical requirements relating to the design and technical specifications of auxiliary ammunition vessels.

Table 3. Subcriteria on Operational Requirements Criteria

No.	Subcriteria Raised	Definition / Assessment Parameters
1	Security	The safety factor of the Ship becomes a high level for assignment as an Auxiliary Ship Ammunition in charge of distributing ammunition to the Naval Bases has a high level of risk due to transporting hazardous materials.
2	Geographical Conditions	It can operate in all Indonesian waters, especially in the waters around main bases, and can sail in sea state 6 conditions.
3	Mobility	The ship has high stability, and good speed and must be able to carry out coat effective sustainable operations to supporting-range operations
4	Sailing Endurance	Resilience at sea is not less than 20 (ten) days.
5	Shipworthiness	Stability meets international standards, has a room that can accommodate large loads, equipped with adequate safety equipment.

Table 4. Subcriteria on Technical Requirements Criteria

No.	Subcriteria Raised	Definition / Assessment Parameters
1	Machinery	Ship propulsion systems, both basic thrusters (MPK) and auxiliary engines.
2	Navigation	An adequate navigation system and integrated communication
3	Safety Equipment	Safety Equipment is good for ships and people in good condition and functioning normally
4	Platform	The shipbuilding system becomes an ammunition warehouse and other compartments that can be used as an ammunition warehouse from the bow to the stern and from top to bottom.
5	Sensor	Early detection tools are integrated with machining, navigation, and safety equipment.

2.5 Alternative Requirements.

Based on interviews, literature studies and questionnaire results from experts to determine the appropriate alternative type of ship to carry out the assignment as an auxiliary ammunition ship can be seen in table 5.

Table 5. Alternatives to Auxiliary Ship Type Selection

No.	Ship Type	Description
1	AT	Drive Tank
2	LST/M	Landing Ship Tank/Modified
3	MA	Markas
4	BAP	Bantu Angkut Personel
5	BRS	Bantu Rumah Sakit

3. RESULTS AND DISCUSSION

3.1 Questionnaire Data Retrieval.

Making questionnaires using a reference model network that has been formed. The questionnaire is made based on the relationship between the criteria elements of both interdependence and outer dependence and the preference relationship between criteria and goals (goal) using a pairwise comparison between clusters and between cluster elements. To make it easier in terms of data processing, a new notation is given for existing alternatives, criteria, and subcriteria. The list of notations is shown in Table 6 below.

Table 6. List of Notations

No.	Name	Code
1	Ammunition Auxiliary Ship Selection	G
2	Operational Requirements	O
3	Technical Requirements	T
4	Security	O1
5	Geographical Conditions	O2
6	Mobility	O3
7	Shipworthiness	O4
8	Sailing Endurance	O5
9	Machinery	T1
10	Navigation	T2
11	Safety Equipment	T3
12	Platform	T4
13	Sensor	T5
14	AT	A1
15	LST/M	A2
16	MA	A3
17	BAP	A4
18	BRS	A5
19	Respondent 1	R1
20	Respondent 2	R2
21	Respondent 3	R3
22	Respondent 4	R4

No.	Name	Code
23	Respondent 5	R5
24	Respondent 6	R6

3.2 Data Processing

The next stage of data collection is data processing activities. The method used in this study is the use of ANP method and the data processing process is carried out with the help of Super Decisions 2.10 software

a. Pairwise Comparison Matrix

After the network model is created, pairwise comparison values can then be determined between criteria and between subcriteria for each alternative. The pairwise comparison score was obtained using a questionnaire. The priority weight value of each category obtained based on the pairwise comparison value will be compared to get the final priority weight value.

The data that has been obtained from the distribution of questionnaires is in the form of pairwise comparison values between criteria and between alternatives for each subcriteria. The assessment of the respondents will be unified using the geometric mean formula as follows.

$$\sqrt[n]{\prod_{i=1}^{n} X_i}$$

Information:

X_i = Decision on the comparison of the 1st criterion

After obtaining one pairwise comparison value for each relationship, a local priority weight calculation is carried out. This calculation aims to find out the weight of each of the interconnected elements. Whenever a local priority weighting is carried out, the priority to be considered is the consistency value, the inconsistency value cannot exceed the value of 0.1. An example can be seen in Table 13 which shows the inconsistency value of the comparison of pairs between subcriteria on the Opsreq criterion. It turns out from Table 13. shows that the Inconsistency Index is 0.013440. The value is still below 10% or 0.1 which means that the answers given by the respondents in this questionnaire are consistent.

Table 7. Inconsistency Index of Paired Comparisons Between Subcriteia on Opsreq Criteria.

Inconsistency	0.01344	
Name	Normalized	Idealized
1. O1	0.46241386	1
2. O2	0.121982009	0.263794015
3. O3	0.071379225	0.154362209
4. O4	0.214627707	0.464146354
5. O5	0.129597199	0.280262359

3.3 Processing with Super Decisions 2.10

After entering all geometric mean into the questionnaire format in the Super Decisions software, the software worked through all the stages of the ANP method by running Synthesize, which contained, among other things, alternative weight values as seen in the red-circled values in the picture below.

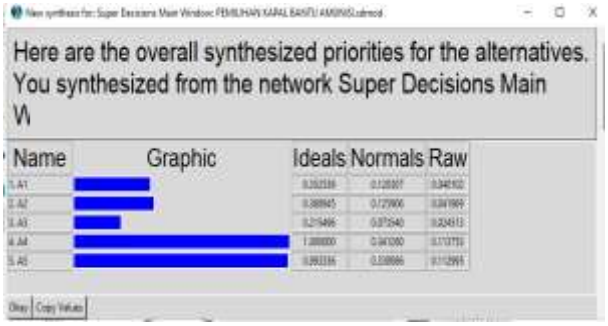
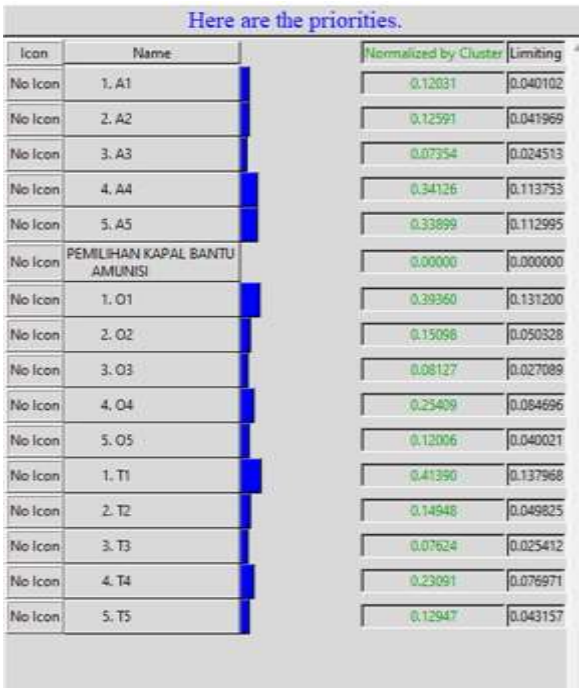


Figure 2. Alternative weight value

Meanwhile, to find out the overall priorities, both alternative priorities, and criteria, you can run Priorities in the Super Decisions software so that weight values from alternatives and criteria are obtained as shown in Figure 3.



Icon	Name	Normalized by Cluster	Limiting
No Icon	1. A1	0.12031	0.040102
No Icon	2. A2	0.12591	0.041969
No Icon	3. A3	0.07354	0.024513
No Icon	4. A4	0.34126	0.113753
No Icon	5. A5	0.33899	0.112995
No Icon	PEMILIHAN KAPAL BANTU AMUNISI	0.00000	0.000000
No Icon	1. O1	0.39360	0.131200
No Icon	2. O2	0.15098	0.050328
No Icon	3. O3	0.08127	0.027089
No Icon	4. O4	0.25409	0.084696
No Icon	5. O5	0.12006	0.040021
No Icon	1. T1	0.41390	0.137968
No Icon	2. T2	0.14948	0.049825
No Icon	3. T3	0.07624	0.025412
No Icon	4. T4	0.23091	0.076971
No Icon	5. T5	0.12947	0.043157

Figure 3. Criteria and Alternative Weight Value

3.3 Sensitivity Analysis

Sensitivity analysis carried out using Super Decisions software is to change the weight value in the alternative test. This test functions for searching the criteria that have bound with the alternative, so the researcher can compare between criteria.

In this test, it will be known that changing the weight value in the alternative test, it will affect the results of the original ranking or not. Whenever there is a point where there is a change in ranking/priority, the point is called the critical point of an alternative. An example can be seen in Figure 5 which shows a sensitivity test at alternative 1 (A1) which resulted in a critical weight value of 0.118660

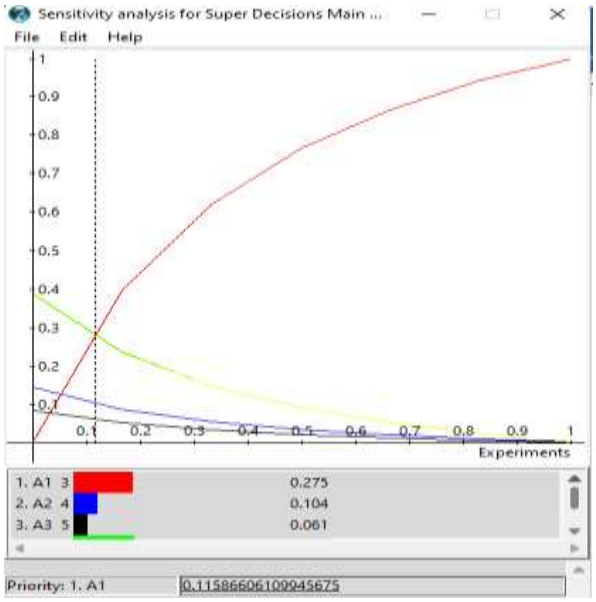


Figure 4. Alternative Sensitivity Analysis 1 (A1

4. CONCLUSION

From the results of data collection and processing, as well as the analysis and interpretation of the results of data processing that has been carried out, the conclusion that can be drawn in this final project is the alternative ammunition auxiliary ship selected is the one that gets the largest priority weight value, namely the type of BAP ship with a priority weight value of 0.34126 Sequentially the alternative priority in the selection of ships for assignment as auxiliary ammunition vessels is the ship type BAP, BRS, LST/M, AT and as the last priority of the five alternatives is the MA. The main/critical criterion

that gets the largest priority weight in the selection of alternative ammunition auxiliary ships is the machining criterion with a priority weight value of 0.41390. Sequentially the criteria in the selection of submarines are Machinery, security, ship worthiness, platforms, geographical conditions, navigation, sensors, sailing resistance, mobility, and furthermore as a priority the last criterion of the existing criteria is safety equipment.

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REFERENCES

Chief of staff of The Navy. (2009). Chief of staff of The Navy Regulation Number Perkasal/39/V/2009 concerning the Basic Policy of Development of the Navy Towards a Minimum Essential Force. Jakarta: Mabesal.

Commander-in-Chief of the Armed Forces. (2011). Decree of the Commander of the TNI Number Kep/258/IV/2013 concerning the Manual for the Implementation of Munitions Development of the Indonesian National Army. Jakarta: Mabes TNI.

Cristopher, M. (2005). Logistics and Supply Chain Management. Creating Value-Adding Networks. Harlow. FT. Press

Kotler, Philip, and Kevin Lane Keller. (2007). Marketing Management. Volume 2. Twelfth Edition. Index. Jakarta.

Law No.34. (2004). Indonesian National Army. Headquarters of the Indonesian National Army.

Saaty. (1990). The Analytic Hierarchy Process. RWS. Publication. Pittsburgh.

Suprapto, Johanes. (2006). Operations Research (For Decision Making). Jakarta: University of in Indonesia Publisher.

Tjiptono, Fandy. (2008). Marketing Strategy. Third Edition. Andi. Yogyakarta